

REMARKS

Claims 4-31, 34-37, 39-53, 55, 57-99, and 108-112 are now pending in this application. Claims 67-99 and 108 have been withdrawn from consideration. Of the claims still under consideration, Claims 4, 19, 22, 25, 31, 35, 37, 42, 50, 53, 58, and 111 are independent. By this Amendment, Applicants have canceled Claims 32, 33, and 38, amended Claims 4, 5, 9, 10, 12, 19, 31, 37, 39, 42, 53, 55, 58, 109, and 110, and added new Claims 111 and 112.

Claims 4-31, 34-37, 39-53, 55, 57-66, 109, and 110, stand rejected under 35 U.S.C. § 102 over U.S. Patent No. 6,331,994 (Ohmi, et al.). Applicants traverse this rejection.

As generally recited in each of the independent claims, Applicants' invention is directed to a laser oscillating apparatus which includes a laser tube filled with a laser gas and a waveguide having a plurality of slots formed in a waveguide wall.

The Ohmi, et al. patent is also directed to a laser oscillating apparatus. That patent also describes a waveguide having a plurality of slots and a laser chamber which stores a laser gas. However, Applicants submit that the Ohmi, et al. patent does not describe specific, novel features of the invention variously recited in the independent claims, as discussed in detail below with respect to each of the independent claims. Applicants also note that, for a rejection under 35 U.S.C. § 102 to be proper, the cited patent "must teach *every* aspect of the claimed invention either explicitly or impliedly. Any feature not directly taught must be *inherently* present." MPEP § 706.02, p. 700-21 (February 2003) (emphasis added).

Independent Claim 4

As recited in independent Claim 4, the laser oscillating apparatus according to Applicants' invention further includes an electromagnetic wave passage for connecting the plurality of slots and the laser tube between the laser tube and the waveguide. A predetermined distance is provided between the waveguide and the laser tube, with that distance being equal to or greater than the half-wavelength of an electromagnetic wave introduced from the waveguide, as generally shown in Figure 5 of the present application. With such a configuration, uniform intensity distribution is introduced into the laser tube.

The Office Action cites Figures 6A, 6B, 8A, and 9A-C of the Ohmi, et al. patent as showing a passage connecting slots of a waveguide and a laser tube. Specifically, the Office Action states that Figures 6A and 6B show a distance from the slots to the laser tube. Applicants submit that none of these figures show the electromagnetic wave passage of the present invention. In particular, Applicants submit that Figures 6A and 6B merely show the length of the waveguide and Figures 9A-C merely show the arrangement of slots.

Accordingly, Applicants submit that the Ohmi, et al. patent fails to disclose or suggest at least the features of an electromagnetic wave passage for connecting the plurality of slots and the laser tube, which provides a predetermined distance between the waveguide and laser tube equal to or greater than the half-wavelength of the electromagnetic wave introduced from the waveguide, as recited in independent Claim 4.

Independent Claim 19

As recited in independent Claim 19, Applicants' laser oscillating apparatus is, in part, defined by the width of the longitudinal end portions of the slots being made

larger than the width of central portions thereof. This configuration provides enhancement of longitudinal uniformity of an electromagnetic wave passing through a slot. An example of this feature is shown in Figures 15 and 16 of the present application.

The Ohmi, et al. patent merely shows rectangularly-shaped slots, as shown in Figures 6A, 6B, 8A, 11A, and 12A of that patent. Accordingly, the slots described in that patent do not have longitudinal end portions wider than central portions thereof.

Accordingly, Applicants submit that the Ohmi, et al. patent fails to disclose or suggest at least the feature of the width of longitudinal end portions of the slots being made larger than the width of central portions thereof, as recited in independent Claim 19.

Independent Claim 22

As recited in independent Claim 22, in the laser oscillating apparatus, the slots are formed apart from a central axis along a longitudinal direction of the waveguide, and each of the slots is curved such that the end portions are closer to the central axis than a central portion thereof. This feature also enhances the longitudinal uniformity of electromagnetic waves passing through a slot. An example of this feature is shown in Figure 20 of the present application.

As discussed above, the Ohmi, et al. patent merely teaches rectangularly-shaped slots.

Accordingly, Applicants submit that the Ohmi, et al. patent fails to disclose or suggest at least the feature of each slot being curved such that end portions are closer to a central axis than a central portion thereof, as recited in independent Claim 22.

Independent Claim 25

As recited in independent Claim 25, the laser oscillating apparatus includes an air-gap structure formed in the waveguide wall in which the slots are formed. With this configuration, reflective electromagnetic waves at the slots are reduced and electromagnetic waves are efficiently introduced into the laser tube.

The Office Action states that Figures 5, 6A, and 6B of the Ohmi, et al. patent show the features of independent Claim 25. However, Applicants submit that those figures do not even show a slot. Further, Applicants submit that an air-gap structure, an example of which is shown in Figures 24-26 of the present application, is not described in the Ohmi, et al. patent.

Accordingly, Applicants submit that the Ohmi, et al. patent fails to disclose or suggest at least the feature of an air-gap structure formed in the waveguide wall in which the slots are formed, as recited in independent Claim 25.

Independent Claim 31

As recited in independent Claim 31, in the laser oscillating apparatus, each of the plurality of slots has a tapered shape whose sectional shape narrows toward the laser tube. This allows for the efficient introduction of the electromagnetic wave into the laser tube. An example of this feature is shown in Figures 28A and 28B of the present application.

Figure 8B of the Ohmi, et al. patent shows a cross-sectional view of the slots described in that patent. Applicants submit that the cross-sectional view shows that those slots are not tapered.

Accordingly, Applicants submit that the Ohmi, et al. patent fails to disclose or suggest at least the features of each of a plurality of slots having a tapered shape whose sectional shape narrows toward the laser tube, as recited in independent Claim 31.

Independent Claim 35

As recited in independent Claim 35, in the laser oscillating apparatus, the width of end portions in a longitudinal direction of each of the slots is made smaller than the width of a central portion thereof. An example of this feature is shown in Figure 23 of the present application.

As discussed above, the Ohmi, et al. patent merely teaches rectangularly-shaped slots.

Accordingly, Applicants submit that the Ohmi, et al. patent fails to disclose or suggest at least the features of the width of end portions in a longitudinal direction of each of the slots being made smaller than the width of a central portion thereof, as recited in independent Claim 35.

Independent Claim 37

As recited in independent Claim 37, an electromagnetic wave in the waveguide of the laser oscillating apparatus forms a standing wave and each of the slots is formed so as to make the center of slot substantially coincident with a node of the standing wave. Again, this feature enhances the longitudinal uniformity of electromagnetic waves passing through the slot. An example of this feature is shown in Figures 29-31 of the present application.

The Office Action cites the Ohmi, et al. patent as describing these features of the invention at column 12, lines 1-6, and column 13, lines 30-35. Applicants submit that these portions of that patent describe the positional relationship between the waveguide and an insulating plate, but do not suggest the positional relationship between the phase of an electromagnetic wave in the waveguide and the slots.

Accordingly, Applicant submits that the Ohmi, et al. patent fails to disclose or suggest at least the features of an electromagnetic wave in the waveguide forming a standing wave and each of the slots being formed so as to make the center of the slot substantially coincident with a node of the standing wave, as recited in independent Claim 37.

Independent Claim 42

As recited in independent Claim 42, the laser oscillating apparatus includes a shielding structure for shielding each of the electromagnetic waves in the laser tube in order to prevent plasma from diffusing. This provides a more uniform discharge. An example of this feature is shown in Figures 34-39 of the present application.

The Office Action cites column 14, lines 23-42, of the Ohmi, et al. patent as describing a shielding structure. That section discusses the features of Figures 13 and 14 of the patent, which figures do not show the slots. Consequently, Applicants submit that this portion of the patent does not suggest a shielding structure for shielding magnetic waves ejected from the slots.

Accordingly, Applicants submit the Ohmi, et al. patent fails to disclose or suggest at least the features of a shielding structure for shielding each of the

electromagnetic waves in the laser tube in order to prevent plasma from diffusing, as recited in independent Claim 42.

Independent Claim 50

As recited in independent Claim 50, Applicants' invention is defined, in part, in that the width in a short-side direction of each of the slots is made smaller than the thickness of a sheath serving as a passage of the electromagnetic waves extending from an opening of each of the slots in the short-side direction. This configuration reduces the fluctuation of sheath thickness and makes uniform the plasma density. An example of this feature is shown in Figure 40 of the present application.

The Office Action cites column 2, lines 56-62, and column 12, lines 22-30, of the Ohmi, et al. patent as describing the features of Claim 50. Applicants submit that this section of that patent (as well as the patent as a whole) does not define the width of the slots arranged on the waveguide.

Accordingly, Applicants submit that the Ohmi, et al. patent fails to disclose or suggest at least the features of the width in a short-side direction of each of the slots being made smaller than the thickness of a sheath serving as a passage of the electromagnetic waves extending from an opening of each of the slots in the short-side direction, as recited in independent Claim 50.

Independent Claim 53

As recited in independent Claim 53, in the laser oscillating apparatus, a plurality of slots are arranged in the short-side direction of the waveguide to form a row of

slots, and a plurality of rows of slots are disposed in the long-side direction of the waveguide. With this configuration, the density of the plasma is made uniform, while keeping enhanced radiant efficiency. An example of this feature is shown in Figure 41 of the present application.

Applicants submit that the Ohmi, et al. patent does not describe arranging a plurality slots in parallel, in a width-wise direction.

Accordingly, Applicant submit that the Ohmi, et al. patent fails to disclose or suggest at least the features of a plurality of slots arranged in the short-side direction of the waveguide to form a row of slots, as recited in independent Claim 53.

Independent Claim 58

As recited in independent Claim 58, the laser oscillating apparatus has a pair of waveguides sandwiching a laser tube, with the waveguides being constructed such that intensity distribution of electromagnetic waves introduced therefrom are shifted from each other. With such a configuration, oscillation efficiency is enhanced. An example of this feature is shown in Figure 45 of the present application.

While the Ohmi, et al. patent describes sandwiching a laser tube with a pair of waveguides (see Figure 17), that patent does not describe shifting intensity distributions of the electromagnetic waves.

Accordingly, Applicants submit that the Ohmi, et al. patent fails to disclose or suggest at least a pair of waveguides sandwiching the laser tube and constructed such that the intensity distribution of electromagnetic waves introduced therefrom are shifted from each other, as recited in independent Claim 58.

Independent Claim 111

As recited in independent Claim 111, the laser oscillating apparatus includes dielectric lenses for concentrating a microwave, which lenses are attached to a plurality of slots. Independent Claim 111 has been provided in lieu of rewriting Claim 33 in independent form.

Applicants submit that the Ohmi, et al. patent does show the use of a dielectric lens.

Accordingly, Applicants submit that the Ohmi, et al. patent fails to disclose or suggest at least the features of a dielectric lens being attached to each of the plurality of slots, as recited in independent Claim 111.

For the foregoing reasons, Applicants submit that the independent Claims are allowable over the Ohmi, et al. patent and request withdrawal of the rejection under 35 U.S.C. § 102.

The remaining claims still under consideration in the present application are dependent claims which depend from the independent claims, and thus are patentable over the documents of record for reasons noted above with respect to those independent claims. In addition, each recites features of the invention still further distinguishing it from the applied patents. Applicants request favorable and independent consideration thereof.

This Amendment After Final Rejection is an earnest attempt to advance prosecution and is believed to clearly place this application in condition for allowance. At the very least, Applicants believe that the Amendment reduces the number of issues for appeal. This Amendment was not earlier presented because Applicants earnestly believed

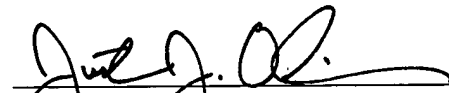
that the prior Amendment placed the subject application in condition for allowance.

Accordingly, Applicants respectfully request entry of this Amendment under 37 C.F.R.

§ 1.116.

Applicants' undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should continue to be directed to our below-listed address.

Respectfully submitted,



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